TAXONOMY OF CARPHOCHAETE (ASTERACEAE-EUPATORIEAE)

B.L. Turner

Department of Botany, Univ. of Texas, Austin, TX 78713

ABSTRACT

A taxonomic treatment of Carphochaete is rendered. Seven species are included in the genus: C. bigelovii, C. durangensis, C. grahamii, C. macrocephala, C. pringlei, C. schaffneri and C. wislizeni. These include the monotypic genera Cronquistia King, and Revealia King & H. Robinson. One new species, C. durangensis, and one new varietal combination, C. pringlei var. simulans, is proposed; in addition C. gummifera McVaugh is reduced to synonymy under D. grahamii. Descriptions, keys, distribution maps, and a complete synonymy are provided.

The genus Carphochaete was first proposed by Gray in 1849 with his description of C. wislizeni. Shortly thereafter (1852) he added two additional species, C. bigelovii and C. grahamii. Greenman, in 1901, added C. schaffneri, B.L. Robinson in 1906 added C. simulans and McVaugh in 1972 proposed C. gummifera. The most recent additions, C. durangensis and C. macrocephala, were first proposed by the late Dr. Jerold Grashoff, who was engaged with a revisionary study of the group at the time of his early death.

I have accepted seven species in the genus including all those proposed by Gray, Greenman, and Grashoff. Robinson's C. simulans has been reduced to varietal status under C. bigelovii and McVaugh's C. gummifera has been placed in synonymy under C. grahamii.

It should be noted that King (1968) excluded C. pringlei from the complex, creating the monotypic genus Cronquistia, and King and Robinson (1976) subsequently described a new monotypic genus Revealia, based upon their R. stevioides. This was soon found to be a synonym of the earlier Oxylobus macrocephala Paray, which name was transferred to Revealia, replacing R. stevioides. In my opinion, neither of the two monotypic genera are worthy of recognition and I follow Grashoff in reducing them here.

CHROMOSOME COUNTS

Relatively few chromosome counts are published for Carphochaete. Those available to date are listed below. The genus would appear to be dibasic with x=11 or 12; two

of the species C. bigelovii and C. grahamii, possess x=11 and C. durangensis has x=12. The latter was reported as Cronquistia pringlei by King et al. (1976).

Taxon	Chromosome count	Reference
C. bigelovii	2n=22	Gaiser (1953)
C. bigelovii	n=11 pairs	Powell and Powell (1978)
C. bigelovii	n=11 pairs	Turner (1959)
C. durangensis*	n=12 pairs	King et al. (1976)
C. grahamii	2n=22	Grasshoff et al. (1972)

A base chromosome number of x=11 or 12 would suggest a relationship with Stevia which is essentially tribasic with x=11,12 and 17. On morphological grounds Carphochaete appears closer to those taxa of Stevia possessing base numbers of x=11 or 12.

GENERIC RELATIONSHIPS

The species of Carphochaete superficially resemble certain species of Stevia (e.g., S. pelophila Blake) as noted by Grashoff (1972) in his monumental treatment of Stevia for North America. Carphochaete, however, is readily distinguished by its style branches, and yet other characters of the head and florets.

Robinson and King (1976) place Carphochaete and their monotypic generic segregates, Cronquistia and Revealia, next to each other near Metastevia and Stevia, which is about where I would place the groups, as would, presumably, Grashoff (1975) to judge from his remarks as to the relationships of Metastevia. That is, the latter genus is closer to Stevia, on morphological grounds, than it is to Carphochaete (indeed, on phyletic grounds I would include Metastevia within Stevia, as presently constituted); but Carphochaete has characters of both Stevia and Metastevia and is perhaps ancestral to both. Certainly the semipaleate, large heads with numerous florets, and bristly pappus of C. durangensis makes that species a likely candidate. But these are matters for the future; any resolution of the problem will require new insights into the groups, especially using macromolecular data.

SPECIES RELATIONSHIPS

As I view the species they fell into four groups as follows: Group I) C. pringlei and C. durangensis; Group II) C. wizlizeni, C. grahamii and C. schaffneri; Group

species \ character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
pringlei	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
var. simulans	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0
durangensis	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0
wizlizenii	0	1	0	1	1	0	0	1	1	1	0	0	1	0	0	0	1	0
grahamii	0	0	0	1	1	0	0	0	1	1	0	1	1	0	0	1	1	0
schaffneri	0	1	0	1	1	1	0	1	1	1	0	1	1	0	0	1	1	0
macrocephala	1	0	0	1	0	0	1	0	1	0	1	1	0	1	1	1	0	1
bigelovii	1	0	0	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1
Metastevia	0	1	0	0	0	1	0	1	1	1	1	1	0	1	–	–	0	0

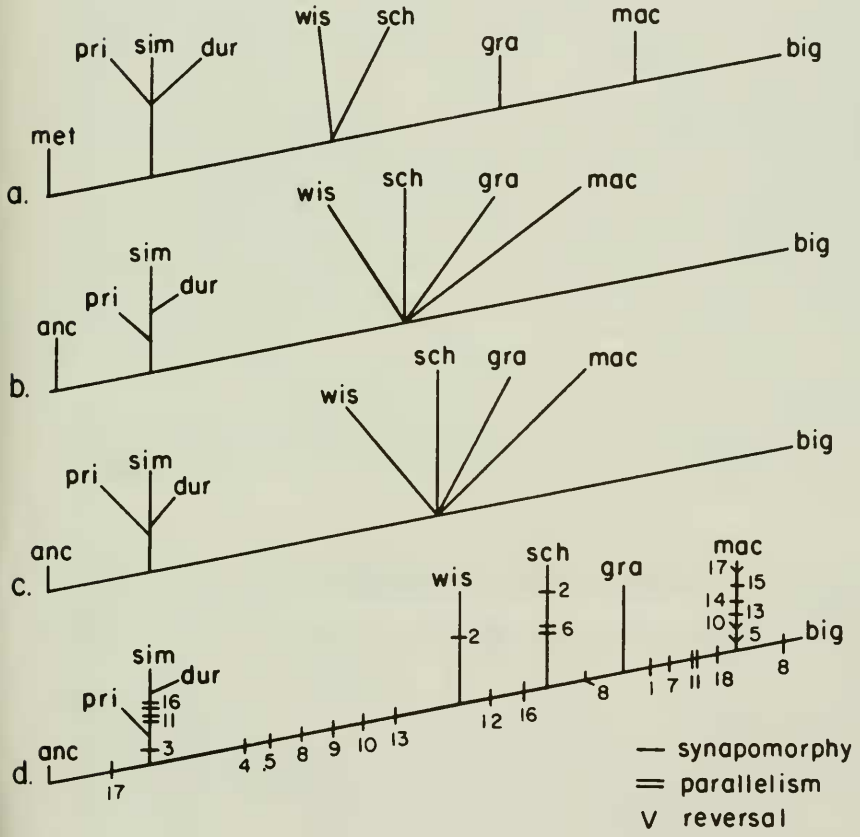
Table 1. Character states among species of Carphochaete and Metastevia.

III C. bigelovii; and Group IV C. macrocephala. The relationships among these are shown in Fig. 1. Construction of the diagram was based upon the following assumptions as regards primitive (0) or advanced states (1) of the characters concerned:

Character	Primitive State (0)	Advanced State (1)
1.Habit	suffruticose herb	shrub
2.Stems	from woody crown	rhizomatous
3.Leaf arrangement	opposite throughout	alternate above
4.Leaf venation	3-nervate	1-nervate
5.Involucral bracts(I.B)	subequal	graduate
6.I.B. vestiture	not glandular	glandular
7.I.B. margins	not scarious	scarious
8.I.B., number	9 or more	5-9
9.Receptacle	chaffy(in part)	not chaffy
10.Florets/head	7-15	3-5
11.Corolla pubescent without	absent	present
12.Corolla pubescent within	absent	present
13.Style node abrupt	not so	yes
14.Achenes	8-9 ribbed	4-5 ribbed
15.Pappus	with mid-rib	w/o mid-rib
16.Pappus bristle no.	4-5	8-16
17.Anthers bifid	not so	yes
18.Heads single and sessile	not so	yes

Character states for the various species of Carphochaete are presented in Table 1 and these were used to construct the cladistic analysis shown in Fig. 1. In this I have used a hypothetical outgroup (HOG), for cladistic purposes. Other workers might have proposed their own HOG but for me, for my analysis of Carphochaete, I like the HOG proposed here. Cladistic purists might wish to have an appropriate "real" outgroup selected for such analysis, but to what avail? I mean, how does one recognize an outgroup where relationships are obscured by reticulate divergence, or whatever. Nevertheless, to this end I have provided such an analysis using the genus Metastevia as an outgroup, since Grashoff (1975) felt that the latter genus "developed from S. elatior-like ancestors during the early colonization of Mexico by members of this group". Stevia elatior belongs to a group of species that share many characters with Carphochaete, thus the selection of Metastevia as an appropriate outgroup is not too far-fetched. Besides, Metastevia is monotypic, making the

Fig. 1. a-d. Cladograms showing relationships among Carphochaete species. a. Consensus tree 1; b. Consensus tree 2; c. Second-level consensus tree; d. Subjective (derived) cladogram-anc=ancestor; met=Metastevia; big=C. bigelovii; dur=C. durangensis; gra=C. grahamii; mac=C. macrocephala; pri=C. pringlei var pringlei; sim=c.p. var. simulans; sch=C. schaffneri; wis=C. wislizeni. Additional explanation in text.



calculations relatively simple. Results of the calculation are shown in Fig.1 .

The hypothesis of phylogeny presented here is based on a cladistic analysis using Wagner parsimony. The computer program PAUP written by David Swofford was used to analyze the data. Two outgroups were used to polarize the character states: (1) the monotypic genus Metastevia, and (2) a hypothetical ancestor (HOG) that best represents my ideas regarding primitiveness in Carphochaete.

Using Metastevia as the outgroup, six trees of 31 steps each and a consistency index of 0.581 were found. They are represented in Figure 1a by a strict consensus tree that summarizes the topologically stable areas of the six trees. Using the HOG, seven trees of 27 steps each and a consistency index of 0.667 were found. They are represented in Figure 1b by a second strict consensus tree. In these two analyses, two lineages are clearly represented: C. pringlei-simulans-durangense, defined by alternate leaves and C. schaffneri-wislizeni-grahamii-macrocephala-bigelovii, defined by characters 4, 5, 8, 9, 10 and 13. If a consensus of the trees in Fig. 1a and Fig. 1b is constructed, the resulting tree (Fig. 1c) provides only this minimal level of resolution. Finally, I offer an admittedly somewhat subjective cladogram (Fig. 1d) constructed from the two consensus trees that displaces unresolved topology from one tree with resolved portions from the other and also that best fits my personal view of evolution in Carphochaete. This tree, however, exactly matches one of the seven trees obtained using the HOG as outgroup. Character state changes have been appended to the tree in Fig. 1d, using HOG to establish the polarities.

It should be noted that the cladistic branch bearing C. durangensis C. pringlei and its variety simulans (Fig. 1d) is at variance with the nomenclature adopted here. That is, the var. simulans, on cladistic grounds, using the data adopted here would more logically be treated as a variety of C. durangensis. However, I have not let my putative phylogeny affect the nomenclature in this instance, for if so treated the correct specific name would be C. simulans, with C. durangensis becoming a variety of the latter. Of course both of these could be treated at the specific level, but lacking new experimental data I have maintained the existing nomenclature so far as possible.

ACKNOWLEDGEMENTS

This study is based upon the examination of approximately 465 specimens, as follows: ARIZ(79), ASU(37), CAS-DS(21), F(24), GH(76), LL(30), MO(32), MICH(38), MSC(20), TEX(60), UC(44). I am grateful to the Directors concerned for these loans. Guy Nesom provided the Latin diagnosis and assisted with the cladistic analyses.

CHARPHOCHAETE A. Gray

Perennial suffruticose herbs or shrubs to 3 m high. Stems arising from short rhizomes or ligneous root crowns. Leaves opposite throughout or markedly alternate, sessile or nearly so, 1-nerved or with 3 parallel nerves, markedly glandular-punctate. Heads large, cylindrical or turbinate, borne in 1-numerous terminal cymes. Involucres 2-4 seriate, graduate to eximbricate, persistent. Receptacle convex or plane, epaleate or rarely partially paleate. Corollas tubular, white, pink or lavender, the throat cylindrical, glabrous or hirtellous without, pubescent or glabrous within; the lobes linear, of differing lengths. Anthers with well-developed appendages, these often with a central rib, or bifid. Style branches filiform with smooth, linear, narrowly-oblanceolate, appendages, the shaft with a gradually or abruptly swollen basal node. Achenes linear to narrowly obpyramidal, 4-5, or more often, 8-9 ribbed, the pappus scales ribless or ribbed, or both. Base chromosome number, x=11 or 12.

Type species, Carphochaete wislizeni A.Gray.

A genus of seven species, all of which are confined to Mexico, mostly from Guerrero northward, where they usually occur in pine-oak woodlands from 1500-3800 m.

Key to Species

1. Leaves predominantly alternate along the upper stems; blades at least faintly 3-nerved.

2. Leaves 5-8 cm long; blades strongly 3-nerved----------C. durangensis

2. Leaves 1-3 cm long; blades faintly 3-nerved----------C. pringlei

1. Leaves predominantly opposite along the upper stems; blades with a single mid-vein.

3. Sprawling shrubs to 3 m high; pappus a laciniate crown; Guerrero----------C. macrocephala

3. Suffruticose erect herbs; pappus of prominent scales; Central Plateau of Mexico.
   4. Heads 3-4 cm high, sessile or nearly so; Chihuahua, Coahuila and adjacent U.S.A.----------C. bigelovii

4. Heads 2-3 cm high, pedunculate, arranged in a terminal capitulescence.

   5. Involucral bracts densely covered with minute, stipitate-glandular, trichomes; San Luis Potosi----------C. shaffneri

   5. Involucral bracts glabrous or merely ciliate, sometimes gummy or viscid
      6. Pappus bristles 8-16----------C. grahamii
      6. Pappus bristles 4-6----------C. wislizeni

CARPHOCHAETE BIGELOVII A. Gray, Smithson. Contr. Knowl. 3:89.1852. TYPE:U.S.A. (MEXICO?): "On the boundary between Mexico and New Mexico", Mimbres" (on type sheet), w/o date, I. J. Bigelow s.n. (holotype GH!)

Perennial suffruticose herbs or subshrubs 0.3-1.0 m high. Stems stiffly erect, densely short-puberulous to glabrate, tan or reddish. Leaves opposite throughout, mostly in axillary fascicles, 1-3 cm long, 3-10 mm wide, sessile or nearly so, 1-nerved, glabrous, linear-oblanceolate to somewhat elliptic (very rarely 3-nervate and somewhat denticulate). Heads large, single, terminal or axillary, mostly 3.0-3.5 cm high, the capitulescence a spike-like or loose corymbose panicle. Involucres 4-5 seriate, graduate, mostly 15-20 mm long, the bracts 10-14, linear oblanceolate, puberulent, glandular-punctate, the apices acute or apiculate. Florets mostly 4 per head; corollas white or pinkish-white, 15-18 mm long, glandular or hirtellous without, pubescent within along the lower part. Achenes 11-12 mm long, 8-9 ribbed, hispidulous; pappus of 10-12 linear-lanceolate scales 12-15 mm long, the mid-rib extending into barbellate bristles 2-4 mm long, the outer pappus of 1-4, ribless, linear scales, 1-3 mm long, or absent; chromosome number, 2n=22.

DISTRIBUTION (Fig. 2): Southern Arizona, New Mexico and trans-Pecos Texas in the U.S.A. and adjacent Son, Chi and Coa in Mexico; pine-oak-juniper woodlands in mostly igneous soils from 1700-2500 M; Sep-Jul, depending open rains.

REPRESENTATIVE SPECIMENTS: U.S.A. ARIZONA: Cochise Co.: Chiracahua Natl. Monument, Bonita Canyon, below Shake Springs, Cupressus forest, 5760 ft, 18 Apr 1975, Reeves

R2519 (ARIZ, ASU). Gila Co.: Tonto Forest, Parker creek, 5750 ft; 9 Apr 1935, Johnson 104 (ASU). Graham Co.: Pinaleno Mts., Frye Mesa Reservoir, 5000 ft. 17 Apr 1985, Johnson 11456 (ASU). Pima Co.: Santa Catalina Mts, Sabino Canyon, "The Horse", 9 Apr 1905, Thornber & Terrell s.n. (ASU, TEX). Pinal Co.: Superstition Mts., Top of ridge, S side, 4000 ft 26 Mar 1932, Gillespie 5468 (GH). Santa Cruz Co.: Cobre Ridge, 10 mi SSE of Arivaca, 4200 ft, 17 Apr 1973, Holmgren & Holmgren 6834 (ASU). Yavapa: Co.: Happy Valley, 13 Mar 1966, Hesselberg s.n. (ARIZ). NEW MEXICO. Dona Ana Co.: Organ Mts, Apr 1852, Wright (GH, TEX). Grant Co.: Emory Point, 6600 ft, 1905, Blumer 189 (GH). Greenlee Co.: Clifton, Apr 1987, Traphagen s.n. (GH). Hidalgo Co.: Animas Mts., 23 mi S of Animas, 6500 ft, 2 May 1976, Hess & Stickney 3760 (ARIZ). TEXAS. Brewster Co.: Chisos Mts., above Lost Mine Peak Trail, 2 Apr 1959, Correll 20692 (LL). Jeff Davis Co.: upper canyon of Limpia Creek, 10 Jun 1926, Palmer 30669 (A,TEX). Presidio Co.: NE slope of Chinati Peak, Horse Creek Canyon, ca 6500 ft, 21 Jun 1942, Hinckley 2516 (ARIZ, GH).

MEXICO. CHIHUAHUA: Sierra Charuco, 17-25 Apr 1948, Gentry 8016 (ARIZ, MICH, UC); Cascada de Basaseachic, ca 2150 m, 27 Apr 1986, Nesom 5457 (TEX). COAHUILA: Sierra de Hechiceros, 17-19 Sep 1940, Johnston & Muller 1311 (GH,LL,MICH,MSC); Sierra Maderos del Carmen, 2100 m, 1 Apr 1974, Wendt et al. 121 (LL); Serranias del Burro, 12 Apr 1976, Riskind & Patterson 1977 (TEX). SONORA: 5 mi E of Esqueda, 27 Mar 1970, McGill & Pinkava 6429 (ASU); 17 mi SE of Magdalena, Palm Canyon, 10 Mar 1979, Steadman & Schmidt s.n. (ARIZ).

CARPHOCHAETE DURANGENSIS Grasshoff ex B. Turner, sp. nov.

C. pringlei var. simulans simile sed foliis multum grandioribus laminis valde 3-nervatis et capitulis grandioribus flosculis numerosioribus.

Perennial, somewhat suffrutiose, herbs 30-60 cm high. Stems glandular-pubescent or puberulous, reddish, stiffly erect, 1-8 arising from a short, fibrous-rooted, rhizomatous caudex. Leaves opposite for the first several nodes then markedly alternate thereafter, 4-8 cm long, 7-14 mm wide, gradually reduced upwards, sessile or nearly so, the blades linear-elliptic, strongly 3-nervate from the base, with fine reticulate-nerves between the major veins, glabrous or nearly so. Heads 2-15, bright pink-lavender to purple, arranged in stiffly erect, terminal, flat-topped cymes, the ultimate peduncles glandular-pubescent, mostly 1-3 cm long. Involucres turbinate, eximbricate or nearly so, 10-13 mm

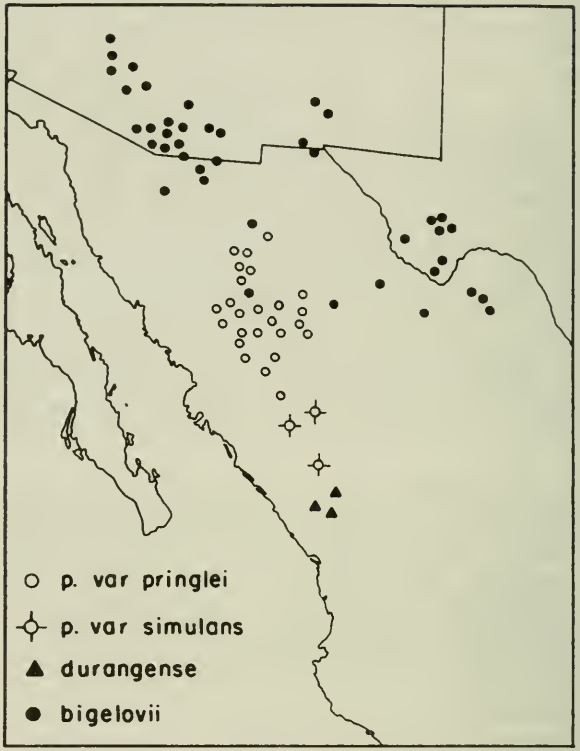


Fig. 2. Distribution of Carphochaete spp.

high; bracts densely glandular-pubsecent, broadly lanceolate, 3-5 nervate, the apices acute. Receptacle somewhat convex, epaleate or with well-developed chaff. Florets 15-20 per head; corollas tubular, 6-8 mm long, pubescent without, glabrous within, the lobes 2-3 mm long. Achenes 4.0-4.5 mm long, 8-9 ribbed, the faces 4 or 5, pubescent; pappus of 3-5 lanceolate scales, 2-5 mm long, with their mid-ribs extending into short bristles, these alternating with 3-5 ribless scales; chromosome number, 2n=22.

DISTRIBUTION (Fig. 2): Known only from southern Durango in pine-oak woodlands, 2400-2700 m; Aug-Sep.

TYPE: MEXICO. DURANGO: ca 30 mi W of Durango, ca 8500 ft, "In rocky, rhyolitic soil in oak-pine woodland". 28 Sep 1962, A. Cronquist 9539 (holotype TEX; isotypes GH!, MICH!, NY).

ADDITIONAL SPECIMENS EXAMINED: DURANGO: 50 km W of Durango along highway 40 (23°52'N x 105°00W), area with much exposed rock, 2500m, 12 Sep 1984, Barrie 1003 (MEXU;TEX); Parque El Teivan, 58 km al ESE de Durango, 4 Sep 1984, Casillas et al. 6 (TEX); Jarocho, railroad W of Durango, 2400-2500 m, 27 Aug 1934, Pennell 18242 (GH).

This taxon superficially looks like a robust form of C. bigelovii var simulans but differs by a number of characters, the most notable being the large, strongly parallel-nerved, leaves. King (1968) included the type and only collection known to him, within his concept of Cronquistia pringlei, but subsequent collections reveal the taxon to be fairly uniform and common to the west and south of Durango City. It does not intergrade with C. pringlei and is remarkably distinct, as surmized by the late J. Grashoff, who first annointed the species and designated its type.

Some of the specimens (Casillas et al. 6, TEX) have well-developed chaff on the receptacles; occasionally, chaff also occurs among the peripheral florets of C. pringlei, contrary to the observations of King (1968).

CARPHOCHAETE GRAHAMII A. Gray, Smithson. Contr. Knowl. 3:89. 1852. TYPE: MEXICO. MEXICO STATE or MICHOACAN: according to McVaugh (1984), who examined type material, the type was probably collected about the villages of Tlalpujahua and Angangueo, in NW Mexico State or adjacent Michoacan, 1830, G. J. Graham 81 (holotype K).

Carphochaete gummifera McVaugh, Contr. Univ. Michigan Herb. 9:385.1972. TYPE: MEXICO. ZACATECAS: between Jalapa

and Tlaltenango, 2300-2500 m, 22 Dec 1970, McVaugh 25617 (MICH!).

Perennial suffruticose herb or shrublets, 30-70 cm high. Stems sparsely puberulent to glabrate, reddish. Leaves opposite throughout, linear-oblanceolate to oblanceolate or somewhat spatulate, 2-4 cm long, 3-7 mm wide, sessile, glabrous to sparsely pubescent on both surfaces, markedly glandular-punctate, 1-nerved, the apices usually obtuse or rounded, but rarely acute. Heads 1-3 at the apices of stems, the ultimate peduncles 5-20 mm long, pubescent to glabrate. Involucres 14-17 mm high, 3-4 seriate, puberulent, ciliate; bracts 8-10, the apices usually rounded and apiculate but sometimes gradually narrowed and acute. Style shaft with basal node. Florets usually 4 to a head; corollas lavender-pink, 15-20 mm long, glabrous within and without, the lobes 5-6 mm long. Achenes ca 1 cm long, with 8-9 ribs, sparsely hispid to glandular-hirtellous; pappus of 8-10 linear-lanceolate scales 9-14 mm long, the apical barbellate extensions mostly 3-4 mm long, an outer series of short ribless scales may be present or absent. Chromosome number, n=11 pairs (Grasshoff 533, TEX).

DISTRIBUTION (Fig. 3): Southern Durango to Mexico State, mostly along the western Central Plateau in pine-oak woodlands, 1400-2700 m; Sep-Nov.

REPRESENTATIVE SPECIMENS: MEXICO. AGUASCALIENTES: ca 10 mi SE Calvillo, 2000-2300 m, 4 Nov 1959, McVaugh & Koelz 179 (LL,MICH). DURANGO: Mcpio. El Mezquital, 22 km NE Los Charcos, 2750 m, 1 Nov 1982, Gonzales & Rzedowski 2347 (CAS, TEX); 74 km WNW Huejuquilla El Alto, 2720 m, 22 Oct 1983, Breedlove 59187 (CAS, TEX); Mcpio. Suchil, San Juan de Michis, 21 Nov 1985, Alvarado 608 (TEX). GUANAJUATO: 30 km WSW Dolores Hidalgo, 2300 m, 29 Dec 1967, Rzedowski 25935 (DS,LL,MICH,MSC). JALISCO: summit of mountains above Etzatlan, 27 Oct 1903, Pringle 8772. (F,GH,LL,MO,MSC,UC). MEXICO: Bluffs, Flor de Maria, 18 Oct 1890, Pringle 3315 MORELIA: Lake Maria, 9 Oct 1911, Arsene s.n. (CAS); ZACATECAS: Sierra de los Huicholes, 5 mi N of Tepetates, 2400-2600m, 13 Jan 1975, McVaugh 25772 (MICH).

Collections from Durango generally have broader more oblanceolate blades which are more puberulent than is typical, but otherwise differ but little from material to the south.

I take C. gummifera to be a somewhat, narrow-leaved, gummy, form of C. grahamii. In nearly all other characters it is like the latter and falls within the

geographic range of that species.

CARPHOCHAETE MACROCEPHALA (Paray) Grashoff ex B. Turner & Kerr, Pl. Syst. Evol. 151:86.1985.

Oxylobus macrocephalus Paray, Bol. Soc. Bot. Mex. 22:1.1958. TYPE: MEXICO. GUERRERO: Cerro Teotepec, NE of Chilpancingo, 3500-3600m, 27 Dec 1946, Paray 973 (MEXU; photoholotype TEX!)

Revealia stevioides King & H. Rob., Phytologia 33:277.1976. TYPE: MEXICO. GUERRERO: ca 60.5 mi NE of Atoyac and 67.5 mi NE of Puerto del Gallo, 10,500 ft, 19 Oct 1975, Reveal et al. 4319 (holotype US).

Revealia macrocephala (Paray) King & H. Rob., Phytologia 23:376.1976.

Sprawling semi-succulent shrubs to 3 m high. Stems puberulent ot glabrate, reddish, the nodes numerous and mostly shorter than the leaves. Leaves opposite throughout, 1-2 cm long, 2-5 mm wide, sessile, 1-nerved, glabrous, oblanceolate, entire or with a few minute serrations. Heads lavender or purple, single or 2-5 in terminal cymes, the ultimate peduncles mostly 2-8 mm long. Involucre campanulate, 2-3 seriate, subimbricate; bracts elliptic with scarious margins, the apices rounded. Receptacles somewhat convex, glabrous, epaleate. Florets 10-14 per head; corollas 13-15 mm long, lavender, tubular, pubescent without and within, the lobes 3-6 mm long. Achenes 6-8 mm long, with 4-5 sides, the faces occasionally with weaker ribs, glabrous or faintly pubescent above; pappus a lacerate crown ca 1 mm high.

DISTRIBUTION (Fig. 4): Known only from Guerrero in the region of Cerro Teotepec in pine-fir forests from 2900-3500 m; Sep-Dec (Apr).

ADDITIONAL SPECIMENS EXAMINED: MEXICO. GUERRERO: Summit of Teotepec, 3100 M, 12 Nov 1973 Breedlove 36075 (CAS); Cerro Teotepec, ca 40 mi N Coyuca de Benitez, Feddema 2931 (CAS,MICH,TEX); 19.5 km al NE de Puerto del Gallo, 23 Nov 1983, Martinez & Barrie 5659 (TEX); Cerro Teotepec, 3300 m, 11 Apr 1963, Rzedowski 16494 (F, MICH, TEX); Cerro Teotepec, 3350m, 5 Dec 1963, Rzedowski 18156 (DS,LL,MICH,TEX); ca 8 km NE de Puerto del Gallo, 7 Sep 1983, Villasenor Rios 558 (TEX).

King and Robinson (1976) thought that this species diverged (as Revealia!) "from between Carphochaete and Cronquistia [=C. pringlei]..." They contend that the

most important difference between these two taxa is that of hairs on the inner surface of the corolla in Revealia. Actually the inner surface of the corolla of Carphochaete bigelovii is pubescent like Revealia and I can find little merit in the recognition of their monotypic proposal, nor did Grashoff, to judge from his annotations.

Nevertheless, the species is perhaps the most distinct member of Carphochaete, possessing a well-defined, semi-succulent, shrubby, habit and 4-5 ribbed achenes, characters which suggest a remote position within the genus.

CARPHOCHAETE PRINGLEI (S. Wats) Grashoff ex B. Turner, comb. nov. Based upon Stevia pringlei S. Wats., Proc. Amer. Acad. Arts 23:276.1888.

Perennial suffructicose herbs 30-70 cm high. Stems purplish, hirtellous to puberulous, but soon glabrate, arising from a ligneous root-stock. Leaves opposite for the first several nodes but thereafter markedly alternate, mostly 2-4 cm long, 2-4 mm wide, gradually reduced upwards, 3-nerved, linear-lanceolate and often somewhat falcate, the apices acute. Heads lavender-pink, turbinate, borne in 1-10, rather flat-topped, terminal cymes, the ultimate peduncles mostly 1-4 cm long. Involucres 2-3 seriate, subimbricate; bracts 14-16, lanceolate, 7-10 mm long, puberulent to glabrate, the apices acute. Florets 3-9 per head; corollas tubular, 6-7 mm long, glabrous or rarely pubescent without, glabrous within, the lobes 2-3 mm long. Achenes 8-9 ribbed, 4-5 sided, densely hispidulous, 4-5 mm long; pappus of 3-5, awned, scales alternating with 4-5 short awnless scales, or of 10 awnless scales 1-2 mm long, these often united into a crown.

Two varieties are recognized:

Involucral bracts and corollas densely pubescent with glandular trichomes; Chi and Dur (Fig. 3)----------var. simulans

Involucral bracts and corollas without glandular trichomes----------var. pringlei

C. PRINGLEI (S. Wats) Grashoff ex. B. Turner var. PRINGLEI

Stevia pringlei S. Wats., Proc. Amer. Acad. Arts 23:276.1888. TYPE: MEXICO. CHIHUAHUA: foothills of the Sierra Madre, Sep 1887, Pringle 3101 (holotype GH!;

isotypes F!,NY,UC!,US!).

Cronquistia pringlei (S. Wats) R.M. King, Brittonia 20:12.1968.

DISTRIBUTION (Fig. 3). Sierra Madre Occidental of Chihuahua and possibly adjacent Sonora, in pine-oak woodlands from 2000-2500m; Aug-Oct.

REPRESENTATIVE SPECIMENS: MEXICO. CHIHUAHUA: SW of Tomochi, ca 2100 m, 25 Sep 1980, Cronquist 11718 (CAS, F, GH, MICH, MO, TEX); 10 mi SE Madera, 22 Sep 1939, Muller 3414 (GH,MICH,TEX,UC).

A large number of additional specimens are cited by King (1968) all of which belong to this variety except for the two collections from Durango which serve as the types of the following variety, and Carphochaete durangensis, described above.

C. PRINGLEI var. SIMULANS (B.L. Rob.) B. Turner, comb. nov.

Stevia simulans B.L. Rob., Proc. Amer. Acad. Arts 42:34. 1906. TYPE: MEXICO. DURANGO: on Mesa de Sandia, 3050m, 14 Oct 1905, C. G. Pringle 10144 (holotype GH!; isotypes F!, NY!,UC!,US!).

This taxon can be distinguished by its copious glandular-trichomes on the upper stems, involucral bracts, and usually the corollas; the latter, if not pubescent, will take on a viscid or gummy sheen. The var. pringlei is usually without glandular trichomes, or these are relatively few and confined to the peduncles. I agree with King (1968) that the pappus characters emphasized by Robinson in his recognition of Stevia simulans are not valid, but the glandularity appears to hold for populations in southern-most Chihuahua and adjacent Durango.

ADDITIONAL SPECIMENS EXAMINED: MEXICO. CHIHUAHUA: 17.6 km NNE of El Vergel, open woods of pine-oak-manzanita, 2450 m, 24 Aug 1983, Nesom 4912 (TEX); 20 km WNW of Santiago Papasquiaro (25° 04' N x 105°47'W), mixed pine, fir and oak woodland, 2800 m, 25 Aug 1983, Diaz 660 [Worthington 11406] (TEX).

CARPHOCHAETE SCHAFFNERI Greenm., Proc. Amer. Acad. Arts 40:34,1904. TYPE: MEXICO. SAN LUIS POTOSI: Sierra de San Miguelito, valley of San Luis Potosi, Sep 1986, J.G. Schaffner 241 (lectotype GH!, selected by King and Robinson, by annotation, 1984; isolectotype F!, UC!).

Suffruticose erect, rhizomatous, perennials, 25-45 cm high. Stems minutely glandular-pubescent to glabrate, reddish. Leaves opposite throughout, sessile, linear-lanceolate, 2-4 cm long, 1-3 mm wide, glabrous, 1-nerved, markedly glandular-punctate, the apices acute. Heads 1, or rarely 2, on terminal peduncles 5-20 mm long, the whole arranged in an open, 3-15-headed, capitulescence with ascending branches. Involucres 10-15 mm high, 2-3 seriate; bracts 5-7, gradually tapering to an acute apex, or abruptly obtuse and apiculate, densely short glandular-hirtellous or merely glandular-punctate, not at all ciliate. Florets mostly 4 per head; corollas pinkish to purplish, 15-18 mm long, glabrous without, very sparsely pubescent within near orfice, the lobes 3-4 mm long. Achenes with 8-9 ribs, ca 1 cm long, minutely glandular-hirtellous; pappus dimorphic, an inner series of 6-8 linear-lanceolate, 1-ribbed scales, 14-16 mm long, the mid-rib extending into well-defined awns, 6-8 mm long, the outer series of 2-6, short, ribless scales, 1.5-3.0 mm long.

DISTRIBUTION (Fig. 3): Mountainous regions about San Luis Potosi in oak woodlands from 2300-2500 m; Oct-Jan.

ADDITIONAL SPECIMENS EXAMINED: MEXICO. SAN LUIS POTOSI: region of San Luis Potosi, 1850-2465 m, 1878-79, Parry & Palmer 329, (GH,MO); Sierra de San Miguelito, ca Cueva del Mezquite, "chaparral de encino", 2300 m, 9 Nov 1954, Rzedowski 5456 (MICH,MSC); Sierra de San Miguelito, "parte superior de la Canada de San Antonio," 2350 m, 5 Jan 1955, Rzedowski 5671 (MSC).

The taxon is closely related to C. grahamii but can be distinguished by its glandular-hirtellous involucral bracts and a few other minor characters. Ultimately it may be reduced to varietal rank under that species.

Collections by Parry & Palmer 329, cited in the protologue by Greenman, in part at least, are apparantly mixed, for sheets at F and MO are clearly C. grahamii, possessing the ciliate eglandular involucral bracts and pubescent achenes of the latter.

CARPHOCHAETE WISLIZENI A. Gray, Mem. Amer. Acad. Arts 4:65.1849. TYPE: MEXICO. CHIHUAHUA: mountains W of Chihuahua, ca Cosiquiriachi, 19 Sep 1846, Wislizenus 175 (holotype MO!; fragment GH!)

Perennial, basally suffruticose, herbs 20-40 cm high. Stems glabrous, or nearly so, reddish, arising from slender rhizomes, forming small colonies. Leaves

opposite throughout, 2-5 cm long, 1-2 mm wide, sessile, linear, glabrous, 1-nerved, markedly glandular-punctate, the apices acute. Heads 1-5 in rather congested terminal corymbs, often numerous-headed, with lateral branches and associated stems producing a flat-topped capitulescence. Involucre 10-12 mm high, 2-3 seriate; bracts 6-8, linear-lanceolate, reddish, ciliate or nearly glabrous, gradually, or rarely abruptly, tapered into an acute apex. Florets usually 4 per head; corollas pinkish-purple to lavender, 13-15 mm long, glabrous within and without, the lobes ca 4 mm long. Achenes 8-9 mm long, 8-9 ribbed, hispidulous; pappus dimorphic, an inner series of 4 or 5, linear-lanceolate, scales, 11-12 mm long, the mid-ribs extending into bristles 2-4 mm long, the inner series of 4 or 5 alternating ribless scales, 1.0-1.5 mm long.

DISTRIBUTION (Fig. 3): Chihuahua, Durango and Zacatecas, pine-oak woodland in mostly rocky igneous soils, 2000-2500 m; Aug-Nov.

REPRESENTATIVE SPECIMENS: MEXICO. CHIHUAHUA: Mountains near Chihuahua, 16 Oct 1886, Pringle 765 (ARIZ, F, GH, LL, MICH, MO, MSC, TEX, UC); Cascada de Basaseachic, ca 2000 m, 4 Oct 1982, Tenorio L. 1 9 6 8 (TEX). DURANGO: ca 50 mi W of Durango, ca 8000 ft, 1 Oct 1962, Cronquist 9579 (GH,MICH,MO,TEX); 49 mi W of Parral, ca 8400 ft, 13 Sep 1972, Reveal & Hess 3058 (GH, MO, TEX, UC). ZACATECAS: ca Sombrerete, ca 2400 m, 26 Sep 1948, Gentry 4876 (ARIZ,GH,MICH,UC).

LITERATURE CITED

Gaiser, L. 1953. Chromosome studies in Kuhniinae (Eupatorieae). I. Brickellia. Rhodora 55:253-267.

Grashoff, J. 1972. A systematic study of the North and Central American species of Stevia. Doctoral Thesis, The Univ. of Texas, Austin.

_____. 1975. Metastevia (Compositae: Eupatorieae): a new genus from Mexico. Brittonia 69:73.

King, R. 1968. Studies in the Eupatorieae (Compositae) VI. Brittonia 20:11-12. 1968.

King, R. et al. 1976. Chromosome numbers in Compositae. XII. Eupatorieae. Ann. Missouri Bot. Gard. 63:862-888.

King, R. and H. Robinson. 1976. A new genus Revealia from Mexico. Phytologia 33:270-280.

Powell, A. and S. Powell. 1978. Chromosome numbers in Asteraceae. Madrono 25:160-169.

Turner, B. 1959. Meiotic chromosomes for 12 species of Texas Compositae. Brittonia 11:173-177.

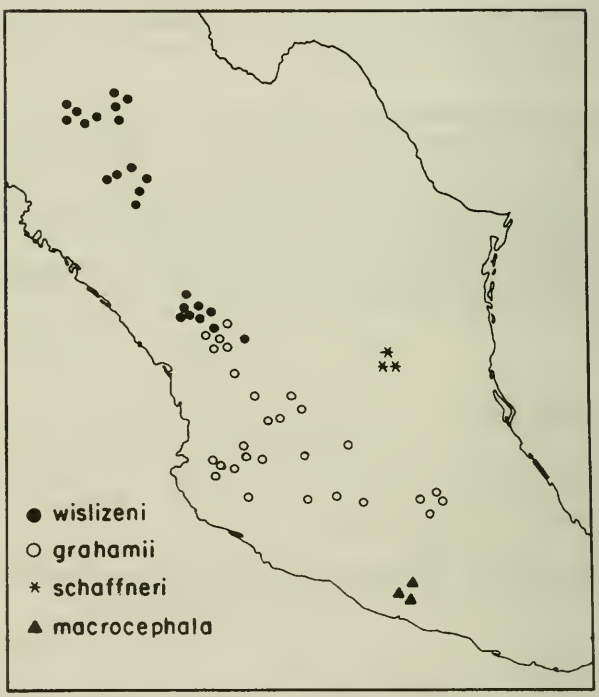


Fig. 3. Distribution of Carphochaete spp.